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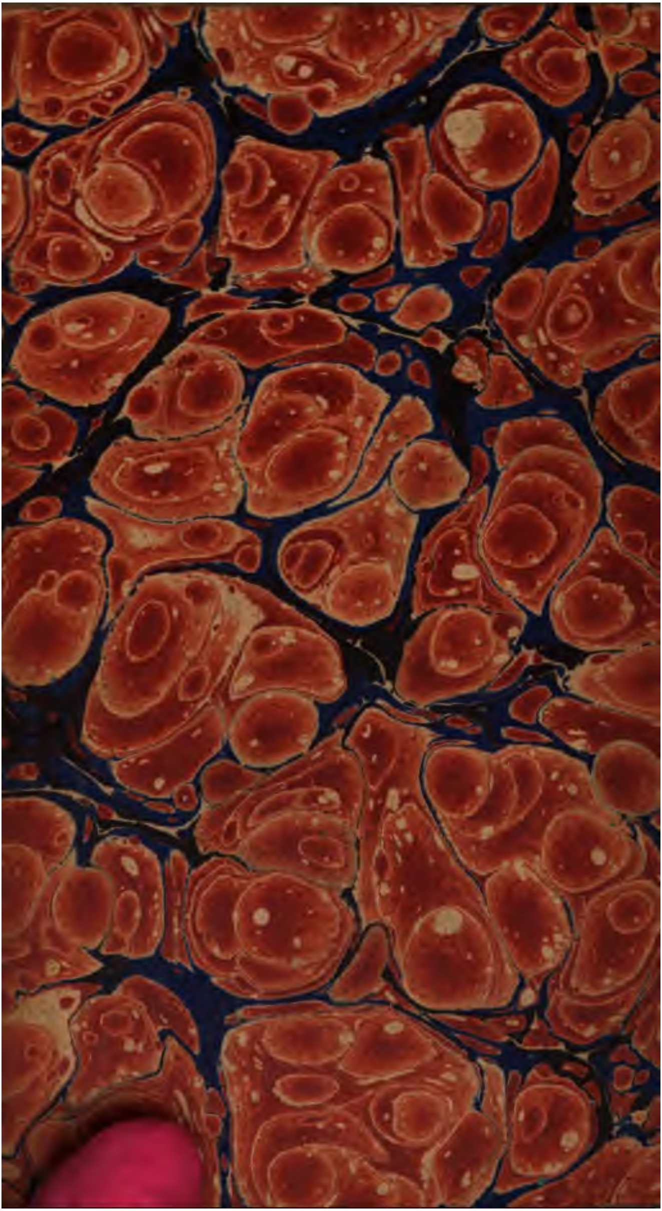

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TREATISE

ON THE MOST

THODS OF MANUFACTU

ABLE IRON SCRAPS

INTO

PLATES, ANGLE AND RI

IRON, &c.

BODL

ROBERT PORTER,
MANUFACTURER AT CARLISLE

Entered at Stationers' *Hall*.]

London:
W. LAKE, 50, OLD BA
THE AUTHOR, ROBERT PORTER, CAR

1841

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☞ *Purchasers of this Pamphlet, who require additional information on the subject herein named, may be supplied with every particular, by applying to the Author.*

TO IRON MANUFACTURERS.

Perhaps in no other manufacture is there so much indifference manifested towards a well regulated operative system, as in that of Bars, &c., from Malleable Iron Scraps. Many without a previous acquaintance launch into this complex manufacture, and for want of necessary knowledge of the various departments, so that the whole may harmonize, fail in realizing that most essential object, namely, to produce certain good qualities under the greatest economy. Manufacturers thus finding themselves disappointed, and knowing nothing better than the system for operating pursued by themselves, imagine there cannot be a better one; and without troubling themselves on this head, continue making sacrifices, which is evident in several works, to the extent of hundreds of pounds per annum. And they think the complaints made by Consumers of the quality of the manufacture cannot be avoided, and that these are a natural consequence due to the multitudinous pieces of which Scraps are composed, and consequently irremediable; whilst they overlook this, that the imperfections of the manufacture arise, not from the number of the pieces, but from the heterogeneous mixture of the Scraps, and the negligent treatment they receive in each stage of that manufacture, wh tends to bring just discredit on the manufacture, and sets the public against it. For example, in the last contract for the supplying chain cables for the use of the Navy, the Board, after investigating whether Scrap-iron Bolts or pudled should be used in their manufacture, decided in favour of the latter. The Inspector over manufacturing the Government Scrap-iron, recommended Scrap-iron Bolts, but a gentleman who had been sent by the Board into the district where chain cables were made, and much of this description of Iron manufactured, returned prejudiced against it. That a good manufacture is held in estimation by some Consumers, is indicated by the following circumstance:—Messrs. Varty and Wilson, of Liverpool, Coach Makers, a few years back, gave £16. per ton for Scrap Bars, when at a work in that Town, now standing, Scrap manufacture was selling at £10.

I have published a Treatise on this manufacture, in expectation that the importance of the subject, and the experience I have had in the manufacture, will meet with a ready and welcome reception among Manufacturers of Scrap-iron. It must be obvious to all reflecting persons, that the system by which good qualities are produced from Scraps, and got up under *two* operations only, with few wasters and croppings, must be a good and economical one, and consequently valuable and desirous to be known.

Malleable Iron Scraps, like Cast Scraps, are of various qualities or properties, and value. Some Scraps are in a further stage of progress towards, and more suitable for, making certain descriptions of Bars, &c., than others; but all are often worked together indiscriminately, which anomalous proceeding produces unsound blooms, and requires such to undergo another operation to render them sounder; the reworking of which incurs a serious expense, besides occupying the work and the time of the workmen.

These evils pervading the generality of Scrap-iron Manufacturies, render them unprofitable; and that they may be avoided, I have laid down rules for working, which if attended to, cannot fail in this particular, and will place a work on the same high ground for making good qualities, as that on which the one at Carlisle stood, which may be ascertained by the extracts from letters which follow, and these shew that the Iron manufactured there gave general satisfaction, and consequently to pursue similar methods in the manufacturing of Iron, must be the interest of a Manufacturer.

Mr. Francis Giles, Civil Engineer, London, says: "I shall at all times be glad to bear testimony to your thorough knowledge of the properties, and of the best methods of working Iron, having witnessed many evidences of that knowledge, in your manufacture of chain cables, and in the plans and opinions you gave to the Newcastle and Carlisle Railway Company, upon the construction of their rails."

Mr. W. Fairbairn, of Manchester, says: "From what I have seen of the Iron, particularly that for Rivets, I consider it to be of an excellent quality."

Mr. Ormrod, of the same place, says: "The Rivet Iron is most excellent."

Messrs. Galloway, Bowman & Co., of the same place, say: "Without exception the Iron is the best we ever had for general use, where strength is required."

Messrs. Rothwell, Hick and Rothwell, of Bolton, say: "We have no objection to state from experience, that the quality of the Rivet Iron is excellent."

Messrs. Thomas Vernon & Co., of Liverpool, say: "The Angle and Rivet Iron is the best we ever used."

The City of Dublin Steam Packet Company, of the same place, say: "The Iron was invariably, and without a solitary exception, very superior."

Mr. Edward Bury, of the same place, says: "The Angle and Rivet Iron was always such as to command a preference in that Market."

Messrs. George Forrester & Co., of the same place, say: "The several parcels have been of the best quality, and well adapted to all purposes where strength is required;—besides, the workmen give it a decided preference to all others for its ductility and property in welding."

Messrs. Scott, Sinclair & Co., of Greenock, say: "Most assuredly we preferred your Rivet and Angle-iron, and other kinds, Squares and Flats, to any we could get at that time."

Messrs. W. Cadell, Sons & Co., of Cramond Iron Works, say: "We have no hesitation in saying, that we consider you to be well acquainted with the different modes of manufacturing Malleable Iron

Scraps; and that by your method, good Bars can be made from any description of Scraps (if clean), in two heats."

To the above, several more letters can be added.

The Treatise on the manufacture of Iron from Scraps comprizes, in connexion with other matter, the following particulars, namely:

A description of the several qualities or properties of Scraps, and the purposes to which the different sorts should be applied,—whether for general purposes as bringing a low price, or for such descriptions as obtain a high price—which are Angle and Rivet-iron, and Iron for plating and polishing, &c. Also the peculiar properties of Foreign Scraps when properly manufactured into Bars, &c., and their superiority over every other description of manufactured iron for smiths' work, &c.

The method of preparing Scraps to the best advantage, as respects yield, &c.

The method of pileing and working Scraps that the several pieces may unite soundly.

The manner in which Scraps should be shingled, to ensure soundness in the finished Iron, especially in Boiler-plate, which is of great consequence, and more particularly so, as a good quality is in demand for locomotive and the principal parts of Marine Boilers. Few works are without making wasters, or in a condition to manufacture plates exceeding three or four cwt.; but for locomotive boilers, plates weighing nearly half a ton are required; and the loss sustained on waster plates of this magnitude is very great. The manufacture of these and Marine Boiler plates is engrossed in a great measure by the Yorkshire manufacturers, who make them from refined Iron, to the almost entire exclusion of Scrap-iron plates.

This latter description being so very liable to shells and unsoundness, renders their manufacture hazardous; and such plates having been sent into the market in an imperfect state, by Scrap manufacturers, has prejudiced the public against them. The Yorkshire manufacturers are not without their share of wasters, although they send none but perfect plates into the market.

The price set upon this Treatise may by some individuals be considered high, but it may be justly observed, that the experience which enables me to compile it, has been gained under no small amount of sacrifices; besides, by so publishing, I am lessening my own importance and value by putting manufacturers into a better state for competing with those who may employ me. But indeed the price is comparatively small, considering the serious evils it is calculated to cure, and the increased demand that must necessarily take place for a better manufacture got up at a less cost, and sold at a higher price.

ROBERT PORTER.

Carlisle, March, 1841.

RULES FOR MANUFACTURING BRITISH AND FOREIGN MALLEABLE IRON SCRAPS INTO BARS, &c.

In laying down rules for the manufacturing of Malleable Scrap-iron into Bars, &c., each department in its order of succession in the manufacture is treated separately; and as the operation commences with the Scraps, they are first treated of. It may be proper to observe, that good and careful Sorters and Pilers, and good Furnacemen, Shinglers and Rollers, should be selected and employed, and a strict discipline kept up, otherwise they get negligent, and evils ensue.

The Scraps.—It is well understood that by repeated working, the quality of iron is improved; and as Malleable Scraps are from bars, &c., which have undergone certain processes in their manufacture, they need only proper treatment in the various stages of their remanufacture to gain much improvement. All Scraps ought to undergo careful examination, picking out whatever may prevent a sound union of the pieces; which unsoundness is denoted by a flame issuing therefrom while shingling, if occasioned by copper, brass, lead, wood, and hard incrustations often found between boiler plates, Coopers' hoops, &c. riveted together. Children are sometimes employed in this important department; the wages paid to them is small in appearance, but it is in reality great; their inattention or inexperience occasioning much iron to be re-worked. The want of care in this particular, is the cause of many complaints from Consumers, it likewise reduces the iron to a level with the cheaper sorts, and sets persons against its use for those purposes which a due care would otherwise qualify it for, and command a better price.

The qualities or properties of Scraps may be classed as follows:—

First, those Scraps which have visible marks of their having been worked under a Smith's hammer, such as horse shoes, nutts, rivets, short screwed bolts, Smiths' croppings, and whatever is known to have been made at a Scrap-iron work.

Secondly, those Scraps wanting the appearance of having been worked under a Smith's hammer, and are, in consequence, of an inferior quality.

Thirdly, Coopers' hoops, sheet iron, nails, rods, coal boxes, and all Scraps of a light description which cannot be piled to advantage.

From the first class may be manufactured iron for plating, and those purposes which require a strong close bodied and durable iron; and also iron for polishing, which will be found comparatively free of black specks, so general in Scrap-iron made in the common way.

From the second class may be manufactured iron for engine and mill-work, and other purposes for which the best price cannot be obtained.

From the third class may be manufactured iron for rivets, and whatever requires a soft and a good bodied iron likewise; such iron will be found to give satisfaction for any purpose Scrap-iron manufacture is used. For rivets it exceeds all in the market, and is got up at a much less expense than the Yorkshire rivet iron; but for plating, polishing, &c. it is not adapted.

From promiscuous pileing Scraps may be manufactured boiler plate, angle iron, &c., not requiring to be made out of the first class of Scraps, but for which purposes the second is altogether too inferior.

From foreign Scraps may be manufactured whatever requires great strength of body and hardness to resist wear, and the effects of friction; and as foreign iron has been ascertained in Ships broken up, to have withstood the action of Sea water the best, this re-manufacture must be well adapted for mooring chains, which being constantly exposed to friction, and that action very soon decay. About the iron maunfactory at Carlisle, a certain piece of smith's work from British Scraps, was much exposed to wear and strain, which had to be very frequently replaced, causing interruptions as well as expense; but upon introducing foreign Scraps re-manufactured, the durability was found to be in the proportion of one to three. This manufacture is particularly adapted for the cranks, tyres, &c., of locomotive engines. For tyres it may be used wholly, or in part, by plating it to British Scrap-iron slabs, to form the face of the tyre; this being the only part exposed to wear. If tyres be made altogether of foreign Scraps, a less thickness (if lightness be a consideration) will be a substitute for tyres made of British iron of the usual thickness, because its strength and durability greatly exceeds that of British iron.

Whatever material large tyres are made of, a considerable expense is incurred in making the bars, and completing the tyres; so that the extra cost of foreign Scrap in tyres is a trifle compared to the advantages gained in the durability. This iron turns well, and has the appearance of steel. It is likewise well adapted for pins which fasten the tyres to the wheels; the smaller these are in diameter, so much smaller may the holes in the tyres be.

Foreign bar iron, as imported, is often in its nature irregular. It is not unusual for a bar to be tough in one part, and brittle in another part; but when the Scraps from those bars are re-worked, an uniformity in this particular follows. The Scraps being numerous and so intermixed, and by the working they get, the iron not only acquires uniformity, but is altogether improved, and still retains that close and dense grain, having been acquired by being previously melted in charcoal, and drawn under a hammer into a bar state; and when worked on the principle here laid down for working Scraps, the manufacture becomes pre-eminent above all other iron. The duty upon the importing of foreign Scraps is 30*s*. per ton, which, with the first cost and charges, may increase the cost £3. per ton above the cost of British Scraps.

In London, foreign Scrap Iron is to be met with, having been taken out of buildings or pallisade fencing pulled down. It was some time back selling at about 40*s*. per ton, exceeding the price of British lump Scrap iron, and may be selling at the same price now.

In the manufacture of plating bars to be worked into spades, the first class of Scraps will need to be used, as having the best body, giving to it an extra operation in one of these ways, namely, the piles, when heated, to be well nobbled under the hammer; re-heated again, and drawn under the hammer to a square, proportioned to the size of the bars into which these blooms are to be rolled: or, blooms of as large a square as can be put through the generality of ruffing down ~~rolls,~~ grooves into flats, cut to lengths, laid together in the usual way, re-heated, and rolled into finished bars. If the size of these finished bars be 3 by ⅝, the flats ought to be 4½ inches wide, of a proportionate thickness, and as many laid together as will form a square, because the iron is improved by its being rolled from a large size down to a small size. It is suggested to those manufacturers who have the means to roll a few blooms, well shingled and while hot, into flats of a good width, to cut these into lengths as just described, pile, heat, and roll them into finished bars, which is only two operations, and being satisfied of the best attention having been given to them in their several stages, send them to a plating hammer for trial.

In the manufacture of Scraps of the first class into iron for purposes which require a strong bodied iron, and to be as clear as possible of black specks, it may be difficult to accomplish the latter object from blooms exceeding 90 or 100 lbs. weight, which have got no more than one operation to bring them into that stage, but by laying slabs together, reheating, and drawing them under the hammer to a proportionate square for rolling, this may be accomplished. Where there is a deficiency in this class of Scraps, the second class may be placed in the inside of piles, the first class forming the bottom, top, and outside.

The Pileing of the Scraps.—Those Scraps suitable for raising a structure being selected, should be piled on plate iron bottoms (old boiler plates) or on wood, and raised as high as is practicable, that when the hammer falls on the pile, which would quickly flatten it, a better square may be preserved when turned on its edge.

The Scraps should be previously cut, when required, into such a state that they may make close compact piles, placing therein a sufficiency of binders that the pieces may adhere better together when the piles come under the hammer; and where there is a deficiency of binders, having some substance, the strongest of the coopers' hoops, at hand, laid singly, will serve for a substitute.

It is a practice in some manufactories, to place pieces of old plate iron on the tops of piles; these seldom unite with the body, where they pass the angle and form a part of two sides. Such pieces ought to be put into the pile lower.down. Where there is an abundance of old boiler plates, the straightest of this may be cut into squares and used as bottoms for the heaviest of the piles.

It would save much trouble by fixing in the pileing bench a simply constructed weighing machine whereon a pile could be raised and the weight ascertained by its lowering, instead of removing it to a beam and scale to ascertain its weight, that the required amount may be added, or subtracted if too much.

Slovenly piling makes an inroad for the flame to waste the iron, prevents a ready union of the pieces while in a welding state, causes the shingler much trouble, and occasions waster bars.

Where light Scraps are piled among a heavier sort, which is frequently done, it is evident that the former must waste greatly before the latter comes to a heat, and cause vacancies; the light pieces lose their welding heat and cannot be made to unite, in consequence of which they have to pass through another operation for their better union; for if they were rolled into bars in their loose state, these bars would generally be of no more value than Scraps.

In some manufactories it is the practice to weigh each lot of Scraps, to make certain weights, and deliver them singly to the pilers. This compels pilers to make piles to suit the Scraps, whereas the Scraps should be selected to suit the piles during their formation; and that pilers may use their own discretion and make better piles, a benchful of Scraps should be placed before them that they may select the pieces.

Lump Scraps are best piled by themselves, filling up the vacancies with pieces of some substance. The medium sized Scrap is best piled by itself too, filling up the vacancies with pieces, such as boiler plate punchings or smaller pieces.

Very frequently boiler plates have shells on them; this is in consequence of introducing light Scraps into the bottoms and tops of the piles, instead of such pieces as would keep their heat and unite soundly.

The Bushelling or Puddling of Light Scraps.—It is evident that all Scraps worked in this way, or in any other way, must be in a sufficient state of heat to ensure a union of the numerous pieces; more is unnecessary and wasteful, and to prevent this as much as possible, workmen ought to be circumspect. In this operation a pudler is generally selected, and if he can work piled Scraps also, which some can, it is a recommendation to his being employed.

The method here pointed out is the best and cheapest to work this description of light and small Scraps, which, being selected and worked by itself, assimilates and unites sounder under a good heat (which it must have) than when intermixed with a heavier sort; and those Scraps of a heavier description, which, being selected and worked by itself, under a good heat, also assimilate; so that by these distinct methods, quality of iron and cheapness of cost is best consulted and obtained.

When there is a sufficiency of light Scraps to employ a furnace in this way, one of a less size than what is used for heating piles is desirable; but they may be worked in a common balling furnace with a little more waste, the sand bottom being previously prepared in the way well known to workmen and which occupies little time. The Scraps being worked in a way similar to puddled iron, and being in small pieces, unite and produce a soft malleable iron, well calculated for rivets, not liable to open in the heads and points like those rivets made out of blooms or billets from piled Scraps. These light Scraps should, if coopers' hoops, be cut into lengths not exceeding 5 inches, or, if sheet iron, into pieces equal to 3 or 4 inches square or smaller, that they may waste less, unite better, come out of the furnace compact, and be clear of those protruding pieces, which is difficult to prevent when the pieces are long and large.

The bushelling of Scraps has been tried at some manufactories, but abandoned, because it was found to be wasteful and productive of unsoundness. The manufacturers must have heard of bushelling beiug practised elsewhere, and from unskilfulness alone, the result has been such. It must have been this, because the method has been practised successfully elsewhere, for instance, at Carlisle, where the best rivet iron in the kingdom was manufactured, the Scraps undergoing no more than one operation in blooming, and sometimes drawn to 2 inches square.

A part of this manufacture was almost invariably used in the angle iron, made at the manufactory just named. The bushelled ball was drawn into a flat of 5½ inches wide and 1¾ thick, and laid to another flat drawn from piled Scraps of the same width, but 3¾ thick, making a square of 5½ inches, to suit the largest grooves in the ruffing down rolls. Care was taken in the rolling to make the thicker slab form the outside of the angle.

From a general assortment of hoops, sheet iron, rods, nails, small links, and pieces of rods under ⅜ square, the waste ought not, in this operation, to exceed 5 to 6 cwt. per ton of blooms, nor the consumption of coal in heating this quantity 15 to 18 cwt., and a good workman will turn out, during twelve hours, from 30 to 35 cwt.

Iron boxes are the best adapted for taking this light Scrap to the furnaces ;—70 lb. is the most economical weight to be worked into a ball; when the weight exceeds that quantity, the waste thereon in heating is more than a due proportion; for instance, when 80lb. is worked, the waste will be from 6 to 7 cwt. in making a ton of blooms. Small and light pieces of foreign Scraps should be worked in this way, and if well executed, makes a most excellent article, superior no doubt to the dented iron, which is sold out to the public in London at 42*s*. per cwt., and there can be little doubt of its plating to the wishes of purchasers when used for the most valuable purposes, such as a fly in cotton machinery, &c.

When two furnaces are employed in working, and a portion of small sizes of blooms is required, it is advisable to employ one in bushelling light Scraps, and the other in heating piles. If piles were to be shingled down to small squares, the time employed in shingling a heat would be greatly extended; therefore these balls which come from the bushelling furnace during the heating of the piles in the other furnace, and the consequent cessation of the hammer, can be shingled down to the required small sizes. By this method, without any inconvenience and interruption, the square of the blooms may be reduced to 2¼ inches, and less when the quantity of scraps worked is diminished.

As the bushelled balls get ready, they should be taken to the hammer, not minding the interruption which it necessarily gives to the shingling of the piles from the other furnace.

The Balling of Piled Scraps.—Little need be said on this head, the method being so much practised. The only consideration is to heat the iron with as little waste, and by as few Coals, as is practicable. The waste on lump pieces should be 1¾ cwt. on a ton of blooms; on a lighter sort, 2 to 2½ cwt.—averaging 2¼ cwt.; and the consumption of Coals for that quantity, 12 cwt. 50 or 60 cwt. is commonly turned out in 12 hours.

The amount of weight put into a furnace may average 10 cwt.: this depends upon its size and the weight of the piles. The above estimate is made from furnaces capable of working half a ton of piles, weighing 70 to 80 lbs. each.

The Shingling of the Scraps.—This is a very important part of the process in the manufacture of Scraps. Cast iron helves, hammers, and anvils, should be cast of mottled pig iron, or a mixture of different sorts to produce the mottle, and melted in an air furnace: because when cast in this way, they are more solid throughout than those cast out of iron melted by means of a blast, and are less liable to be broken. There should be a due regard paid to the weight of the helve, and the speed at which it is driven. It should be 3 tons weight, having a heavy tail and light head, going at the rate of 110 blows per minute for shingling blooms and boiler plate slabs singly; and where there is a heavier helve, in a work used for putting slabs together, these single slabs, after being formed under the light helve, may be taken to the heavy one if convenient, and finished as single slabs, to expedite the labour. A helve too weighty for shingling Scraps, knocks the pieces from their position in the piles, while in a fusible state, and cannot be made to unite in that state. Where there is only one helve, and that is weighty, the introduction of a piece of wood on the anvil, will limit the fall of the hammer, until the Ball comes to a consistence, and able to receive the full fall.

Soon as a ball is laid on the anvil, the shingler ought to be prepared with the stave that it may be driven in quickly, and enable him to set the ball on its edge soon to bring it to a square. The ball should then be reared on end; having by this time gained length, and after receiving a few blows in this position, bringing the Scraps together, in that way too, as well as longitudinally, it will incline to bend. It should be laid on the anvil again, brought straight, and reared once more, after which it may be put into the hands of the assistant to reduce to the required sizes. This procedure will give the bloom soundness, and the ends being square, will render cropping of bars unnecessary. In these cases, where there is

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visible impurity in the ball, it ought, if practicable, to be drawn to a small size, and cut at that part, but if not, it should be laid aside, and used for inferior purposes.

Careless Shinglers often permit a ball, soon as it is laid on the anvil to be so much flattened, that when placed on its edge, it doubles under the blows of the hammer, and when completed, is in a state similar that where two slabs are laid together for rolling into a bar.

In rolling the latter, a roller is able to keep this union, or combination, in the flat way of the bars, but not in rolling the former, because he cannot see into the interior of blooms ; and if these blooms be rolled into flats, the union is just as likely to be in the contrary way of the bars, as in the flat way ; and if these be the contrary, and laid on carriage wheels, the jolting will occasion an opening at this part, and render a removal necessary before the tyres be worn to the usual thinness.

The square of blooms ought to be proportioned to their weight, as some have deficiences upon their surface which would be apt to appear on bars when the blooms are small in their square ; but if larger, admit of being put through more grooves to come to the finishing one, by which time these deficiencies often disappear.

In drawing out slabs to be laid together and rolled into large sized bars, attention should be paid to their being well shingled to the size, that they may lay close, and press through the first groove without interruption, and roll more prefect.

Rolling Mill.—The quality of iron is little dependant on the rolling, as may be seen in the preceding pages. Bars well rolled, and of a sightly appearance, is a great recommendation to their sale; for, as wherever this point is neglected, it may to a certainty be surmised, that little regard has been paid to the quality. In Scrap-iron works, the utensils are not so perfect as in great manufacturing districts; and very frequently bars may be seen to have a reed the whole length, which is generally caused by one or more of the grooves in the ruffing rolls diminishing too much in the size, below the preceding groove.

The waste on blooms, in rolling into bars, may be estimated at 2 cwt. per ton, and the consumption of coals at 10 cwt. per ton during the time of working, which is twelve hours.

Sound made blooms have an advantage, there being no call to put them to an excessive wasting heat, which is often put on blooms of a contrary make; besides, the wasters are very few, and the cropping of the bars unnecessary. The ends are better left on, they are a distinguishing mark of the bars having been rolled from hammered blooms. When slabs are laid together, cropping in this case is necessary, as they occasion long raw ends. It